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HOG CHOLERA; ITS ECONOMIC IMPORTANCE AND PREVENTION

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EVERY "ultimate consumer" knows that there is an insistent demand for more fats and more meat. Every live-stock breeder knows that the grains that formerly have been used to produce these commodities are commanding prices that well-nigh prohibit their use in meat production. Every live-stock statistician knows that our supply of meat-producing animals is diminishing. And every scientist knows that we must have meats and fats. When these facts are forced to our attention with greater emphasis every day, and when we begin to seek a solution of this one of many problems the war has so suddenly thrust on us, we turn instinctively to the hog. And as with Postum, "There's a reason."

The hog is by far the most economical producer of any of our meat animals. Four or five pounds of dry matter fed to hogs in the form of grain will produce a pound of gain; it requires ten or twelve pounds of dry matter to produce a pound of gain in beef cattle. The fat hog yields almost 80 per cent. of his live weight as dressed carcass; the fat steer dresses only about 60 per cent. of his live weight. In addition to the fact that the hog makes the most of every pound of feed given him, he will eat feed that other animals spurn. City garbage, tankage, small potatoes, and the like, he devours with avidity, converting them promptly into palatable and nutritious human food.

The hog reproduces so rapidly that comparison in this respect with other meat-producing animals leaves us wondering how the latter can survive. A good beef cow bred to-day will have to her credit a year from to-day a calf weighing, at best, three hundred pounds. A good brood sow bred to-day will have to her credit a year from to-day three quarters of a ton of finished pork. If she is bred a second time she will also have to her credit at the end of the year from six to ten pigs such as we roast for Thanksgiving. Speaking in mechanical terms we have rapid acceleration applied both to production and reproduction of swine. In fact, we are not much in error in say-

ing that we have arithmetical progression exemplified in reproduction of beef cattle, and geometrical progression exemplified in reproduction of hogs.

Adding to all these advantages the fact that pork may readily be cured so that it will keep weeks and months at room temperature without deterioration, we have in a nutshell the reasons why the hog still finds a place in intensive farming, in spite of the fact that beef cattle are being crowded out.

But with all the outstanding advantages the hog possesses as a producer of meat, he has one vulnerable point. He contracts hog cholera and dies. True, he is subject to many other diseases that are more or less destructive to him, but hog cholera is his Nemesis. When it attacks one hog in a herd, it usually attacks all, and with the exception of a few stragglers, all succumb. In 1914, the disease cost our nation \$75,000,000, killing more than 10 per cent. of its swine population.

In this country, hog cholera appeared first in the Ohio valley, in 1833. Its ravages increased as transportation facilities multiplied, and, as early as 1875, when bacteriology as a science was yet in its infancy, the losses caused by it were so extensive that swine breeders regarded it with universal dread, and it was curtailing, in an alarming degree, America's swine industry.

At this time the science of bacteriology was unfolding a new world. The bacteria, or germs, as they were called, that cause some of the infectious diseases, had been discovered and described, and there was an eager and perhaps hurried search in other directions. Hog cholera, because of its tremendous economic importance, became the object of close and prolonged study, and the researches conducted with this disease are among the most interesting that have occurred in the development of the veterinary sciences.

In 1885, Dr. Elmer Salmon and Dr. Theobald Smith announced that they had discovered the cause of hog cholera, and their findings were corroborated and accepted by trained investigators in this country, and in Europe. This organism (*Bacillus cholerae suis*), a member of the colon group, could be isolated in pure culture from the organs of hogs dead of cholera, it could be grown for generations on culture media, and when these cultures were injected back into other hogs they sometimes caused them to sicken and die. Cultures from the organs of these dead hogs revealed the presence of *Bacillus cholerae suis*, and the incriminating evidence was regarded as complete.

Meanwhile the science of preventive medicine was developing rapidly, and vaccines, serums, and bacterins had sprung into existence. Pasteur had produced vaccines that prevented fowl cholera, rabies, and anthrax, and scientists were eagerly seeking to prevent other infectious diseases in a like manner.

Here again, hog cholera received its share of attention, but all the efforts to produce an effective vaccine by using cultures of *Bacillus cholerae suis* ended in disappointment. Outbreaks of hog cholera still occurred in the field with the same deadly results, and hog raisers still continued to buy nostrums of all descriptions in the forlorn hope of checking the ravages. This state of affairs continued until the close of the nineteenth century, at which time there was a growing belief among some scientists that *Bacillus cholerae suis* was not the real cause of the disease.

This belief was supported by certain facts which will be mentioned presently, and consequently a further search was made for the organism responsible for this disastrous disease. The outcome was that in 1903 de Schweinitz and Dorset of the United States Bureau of Animal Industry announced that it was caused by a filterable virus. This announcement was received with considerable skepticism by those who had followed the long and difficult trail of the *Bacillus cholerae suis*, and who had for eighteen years accepted without doubt its etiological connection with hog cholera. Had not the organism been found repeatedly in the organs of hogs dead of cholera? Had it not been isolated in pure culture and grown in the laboratory for generations? Had not the cultures produced disease and death in hogs to which they were given? Was not the organism found in pure culture in the organs of hogs thus killed? In short, had not *Bacillus cholerae suis* conformed to Koch's dicta?

As a matter of fact it had not wholly, because cultures did not produce disease and death with any degree of regularity. Closer study also revealed the fact that hogs to which the cultures were given did not develop lesions precisely similar to those found in hogs dead in field outbreaks, nor did these artificially infected hogs transmit disease to healthy ones in contact with them. Finally, it was found that hogs artificially infected, and recovered, were not immune to outbreaks of natural infection. Thus there were good reasons to doubt whether *Bacillus cholerae suis* caused hog cholera.

On the other hand, the evidence against the filterable virus was piling higher and higher. Repeated experiments showed

that blood from cholera-infected hogs when passed through fine filters capable of removing all visible bacteria (*Bacillus cholerae suis* included) still remained constantly infectious. More than that, the few hogs that sickened as a result of doses of the filtered blood, and subsequently recovered, were found to be immune to field outbreaks of hog cholera. The mask was at last removed and the filterable virus, after remaining in disguise eighteen years, was revealed to the scientific world as the true cause of hog cholera. Although it did not conform entirely to Koch's dicta, in that it could not be grown in the laboratory, the evidence against it was so conclusive that it was allotted a conspicuous place in the rogue's gallery.

But the filterable virus of hog cholera is found to be far less amenable to the Bertillon system than is *Bacillus cholerae suis*. The latter organism is easily visible with the compound microscope, it grows readily and somewhat characteristically on common culture media, producing gas and acid with a regularity comparable to that observed in chemical reactions. The filterable virus will do nothing of the kind. So far it has refused to grow in any culture medium except the hog; so far it is distinguished by what military men might term "low visibility," at least it is invisible with the strongest microscope; so far its morphological characteristics remain unknown, so it has been placed, in company with others of its stripe, in the pigeon-hole labeled "filterable viruses." Meredith spoke a great truth when he said, "Mankind is the sport of invisible powers."

But after all, what difference does it make how a certain organism behaves in the laboratory if its ravages in the field can be controlled? After numerous baffling attempts directed toward growing the filterable virus artificially, scientists turned their attention toward the latter problem. One fact gave great promise. There was observed an active life-long immunity in hogs that had recovered from hog cholera. Could this immunity safely be produced artificially?

Because the virus could not be grown in the laboratory, vaccines prepared in the usual manner were out of the question. Serum from immune hogs gave disappointing results, but it remained for Dorset, Niles and McBride, of the United States Bureau of Animal Industry, to demonstrate that immune hogs will tolerate enormous doses of blood drawn from hogs sick with cholera, and that subsequently blood from these immunes, or hyperimmunes, as they are called, will prevent cholera in

susceptible swine. This blood became known as anti-hog cholera serum. But the immunity produced proved to be of short duration, unless the hogs treated for protection were exposed to hog cholera near the time at which the serum was administered, so it came to be the practise to produce this exposure by injecting each animal with a small quantity of hog cholera blood at the same time that serum treatment was given. It was found that this produced a lasting immunity, and that it involved but little danger to the animals thus treated.

The product known as anti-hog cholera serum is nothing more than the defibrinated and carbolized blood of hogs that, prior to bleeding, have had their immunity built up by enormous doses of hog cholera blood. Under ordinary circumstances, one cubic centimeter of hog cholera blood will kill a two-hundred-pound susceptible hog, but the immune hog of like size will tolerate a quart of this blood injected into the blood stream.

Anti-hog cholera serum, before being sent into the field for use, is subjected to rigid tests to prove its potency, and when it is carefully prepared it passes these tests with clock-like regularity. It is required to protect hogs given sufficient doses of hog cholera blood to kill them, and exposed, in addition, to natural infection by being placed in a pen with hogs sick with cholera. And it is with a feeling akin to triumph that the serum producer observes his serum-treated hogs surviving the ordeal with no outward signs of disease.

Is hog cholera conquered? Not by any means, but we have in our hands the instrument with which it is possible to conquer it. We can say to any individual breeder with perfect confidence that he does not need to lose his hogs with cholera unless he elects to do so. But our weapon is double-edged, and it is not without flaws in workmanship.

When hogs are treated with serum and virus to produce a permanent immunity, one occasionally sickens, to the extent that he secretes hog cholera virus in his urine. This virus is just as dangerous for other hogs as it would be were the sick hog naturally infected with cholera. In the immediate herd treated this makes no particular difference, because all the hogs are immunized, but new centers of infection may sometimes be produced, from which the virus may find its way to other herds. This danger is greatly augmented when untrained men use serum and virus, and it grew to be so serious that even private serum laboratories, interested in selling as much serum as possible, refuse to sell their products to others than graduate

veterinarians, because they realize that if these products are used by untrained men, they will, in the long run, be discredited.

The danger incident to untrained men in the field is no greater than that due to untrained men in the laboratory. The federal government has recognized this fact, and it now places an inspector in every laboratory that manufactures serum for inter-state shipment. The business of the inspector is to see that the laboratory is kept clean, and that the serum offered for sale is carefully handled and tested.

Even when there is a plentiful supply of potent serum, though, there are various obstacles that militate against its most effective use in the field. It is used as a cure instead of as a preventive, it is used to prevent diseases incorrectly pronounced hog cholera, serum alone is used when both serum and virus are required, and *vice versa*. Each time serum is wrongly used and bad results follow, there is created a certain degree of skepticism regarding its effectiveness.

Added to these obstacles we have constantly with us certain well-meaning but half-informed persons who enthusiastically advise all farmers to have their hogs treated with serum. Such advice is almost equally absurd as would be the order of a fire chief who would direct his men to dash down the street with the chemical wagon, squirting soda and acids indiscriminately in all directions, because one house happened to be on fire. Obviously the efforts should be directed at the seat of the trouble, and at points where danger appears imminent. It is also true that unconsciously, perhaps, there has been a certain relaxation in the enforcement of quarantine regulations since hog cholera serum came into use, and the serum has too often been regarded as a substitute for sanitary measures, rather than as an adjunct to them.

What is the attitude of hog raisers toward hog cholera serum? This is an important consideration, because it must ultimately determine success or failure, as far as hog cholera control is concerned. Skepticism prevailed when the discovery was first announced, and even to-day, ten years after that announcement was made, this skepticism is not wholly dispelled. But to those of us who are engaged in the manufacture and use of serum, the wonder is that so much, rather than that so little, progress has been made. Scientists are likely to complain that their devious trails are not closely followed by those whom their efforts are supposed to benefit, and from time to time various educators complain, and too often with justice, of the vast store

of useful knowledge that has received decent burial in books. But Emerson's law of compensation remains always effective, and there is one great advantage associated with the fact that the layman does not follow the scientist too closely. He may meet the scientist coming back.

In the case of hog cholera serum, though, this skepticism, now fast disappearing, has worked great harm to our swine industry, and it has been fostered, not only by certain swine breeders who have to be shown, but by certain "quacks" in the veterinary profession. The doubting farmer is the one who has for years been trying every form of nostrum advertised to prevent or cure hog cholera. The doubting "quack" is the man who has prepared the nostrums.

Nevertheless, it is true that in the great hog-raising states of the Union, there exists to-day no doubt in the minds of progressive hog raisers as to the effectiveness of hog cholera serum. In fact this confidence is so strong that from time to time there arises a short-sighted but insistent demand that hog cholera serum shall be made and distributed free as a

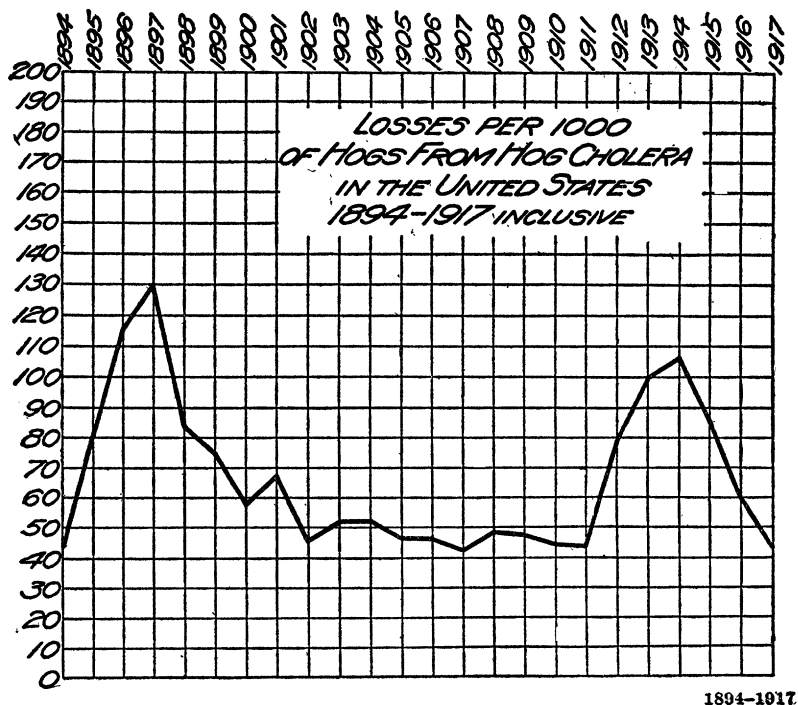


FIG. 1. Losses from Dog Cholera in the United States for the years ending April 1, 1894-1917.

governmental function. This would entail an immense and unnecessary expenditure of public funds, because thousands of doses of serum would then be used without cause, and the supply to meet the legitimate demand would be insufficient. Worse still, serum would be used universally as a preventive of practically every malady that affects swine, and every failure would help to break down confidence in its effectiveness.

What progress is actually being made toward the suppression of hog cholera? One hesitates to quote statistics because one is always reminded of a certain analogy that might be suspected of existing between a person quoting statistics, and the devil quoting Scripture. But I am venturing to include a curve prepared by Dr. J. R. Mohler, chief of the Bureau of Animal Industry, illustrating in graphic form the annual losses from hog cholera throughout a term of years.

If we remember that hog cholera serum came into use in 1908, and if we examine this curve with that fact in mind, we do not at first see much encouragement in the figures presented. But if we remember that during the years when the curve was ascending the facts regarding the effectiveness of hog cholera serum were not generally known, if we remember that its use was but imperfectly understood, if we remember that during those years the supply of serum was far short of the demand, we gain a new understanding of the situation.

Further, when we are told that as far back as 1887, the annual losses from hog cholera reached a proportion of 120 per thousand, and in 1897, a proportion, as the curve shows, of 130 per thousand, we are inclined to believe that the wave whose crest was reached in 1914 was in reality a wave cut short. The downward tendency of the curve since 1914 gives renewed encouragement, but while we must wait several years before we can be sure that this downward direction is maintained, and that it is due to the use of serum, rather than to a normal fluctuation, we believe it can truly be said that out of the misunderstandings and chaos inevitably wrought by a remarkable discovery of his kind, there is steadily and surely being constructed a beaten trail leading to the goal—the complete control of hog cholera.